

Mariner Mars 1971 Mission Support

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The DSN support plans for the Mariner Mars 1971 mission have been modified by a move of the analog playback function from the SFOF media conversion center to the DSIF Compatibility Test Area, and by the DSN assumption of the responsibility for sequence of event generation computer software. Both of these new plans are discussed.

I. Introduction

Two major changes recently occurred in the DSN plans to support the *Mariner Mars 1971* Project. First, all planned usage of the SFOF media conversion center (MCC) was diverted to the DSIF Compatibility Test Area (CTA 21). Secondly, the DSN assumed responsibility for the Sequence of Events Generation (SOEGEN) Program and is converting it to a multimission capability. Each of these changes will be discussed in detail.

II. Analog Playback Facility

Until recently, the SFOF MCC was to operationally support *Mariner Mars 1971* in two roles:

- (1) Conversion of analog recordings of occultation data from DSSs 41 and 62 to a digital form in order to be computer compatible (Ref. 1).
- (2) Playback of predemodulation analog telemetry recordings, through a subcarrier demodulation assembly (SDA), to produce digital recordings identical to the DSIF produced telemetry ODR (Ref. 2).

The MCC plan was to perform both functions using a PDP-7 computer and various special-purpose equipment.

The new plan takes advantage of existing equipment and operational software in CTA 21. This results in a significant cost saving—the primary reason for the change. The configuration for the analog playback capability, serving both the telemetry and occultation data requirements, is shown in Fig. 1. The FR 2000 analog record/playback device provides, with high time-base stability, an analog telemetry input to the subcarrier demodulator assembly (SDA). Subsequent telemetry processing is identical to the processing at any DSS; demodulation is performed by the SDA; symbol synchronization is performed by the symbol synchronization assembly (SSA); and an original data record (ODR) digital recording is written by the telemetry and command processor. Although not planned for operational usage, the data could be sent directly to the SFOF IBM 360/75 computer via high-speed (4800 bps) or wideband (50,000 bps) data lines. It should be mentioned at this point that predemodulation recordings cannot be replayed directly from the receiving

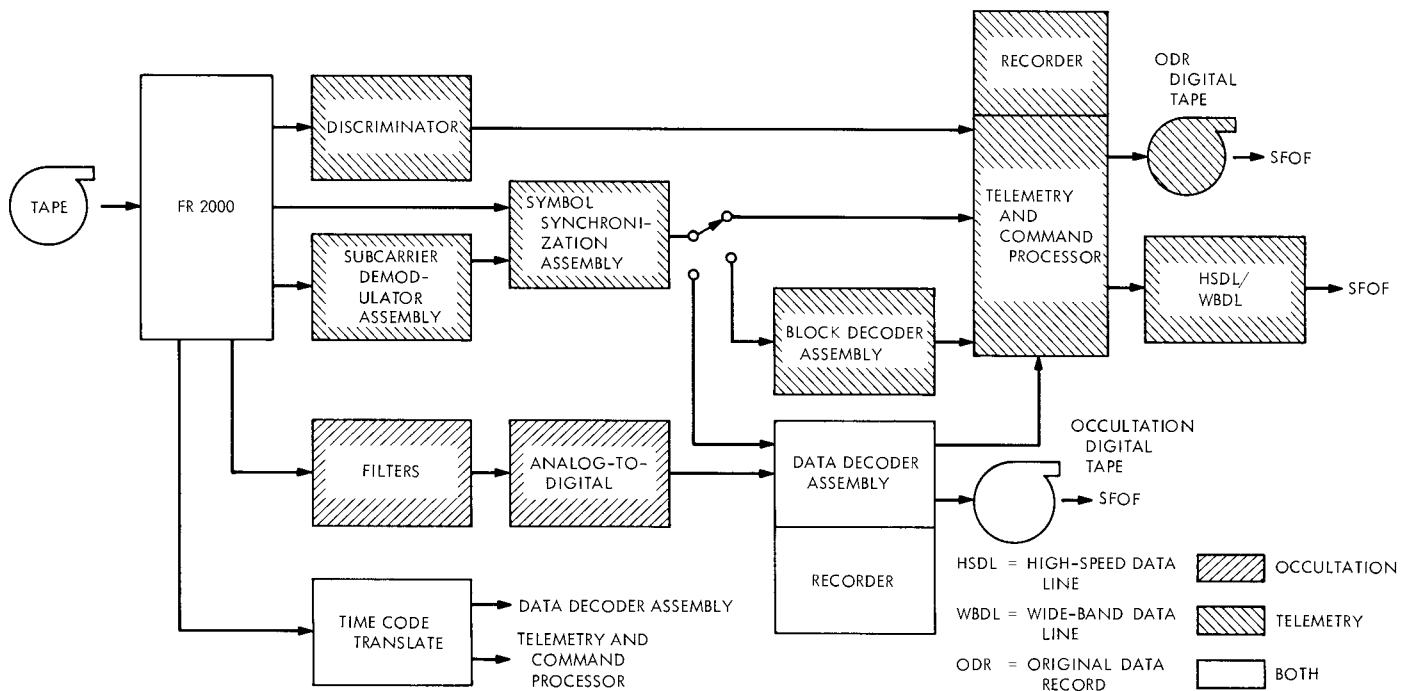


Fig. 1. CTA 21 analog playback capability

DSS as can postdemodulation recordings, because of a time-base stability problem; only DSS 14 and CTA 21 have the FR 2000 record/playback devices. It is planned to use this capability only when the SDA has failed and the data is required for the master data record.

The FR 2000 is also used to playback recordings of open-loop receiver data for the *Mariner* Mars 1971 occultation experiment. DSS 14 will have an on-site digitization capability, but DSSs 41 and 62 will not. Recorded data from the latter stations will be played into a mini-computer (the data decoder assembly [DDA], which is normally used for other purposes) after filtering and undergoing analog-to-digital conversion. The format of the DSS 14 and the CTA 21 recorded tapes will be identical.

III. Sequence-of-events Generation

A sequence of events is necessary to both mission and DSN operations. In the past, sequences were printed from manually prepared punched cards and from make-shift computer programs, which likewise had manual inputs. The complexity of the *Mariner* Mars 1971 mission, with its 24-h adaptive operations cycle, obviates the need for a sequence-of-events generation capability which requires less manual labor to prepare, which can be executed in a short period of time, and which is as foolproof as possible.

The sequence which contains all events of interest to everyone is obviously operationally burdensome. For instance, the DSIF is not very interested in all the steps that the Command Team may be executing. In a mission of nearly continuous high activity, such as *Mariner* Mars 1971, the ability to generate subsequences of special interest becomes all the more important.

With these types of general requirements, the *Mariner* Mars 1971 mission operations system (MOS) undertook the specification of a sequence-of-events generation program. The implementation was split into two phases: Phase 1 for launch and cruise, and the more complex Phase 2 for orbital operations. Implementation was jointly funded by the DSN and *Mariner* Mars 1971 Project. Recently, it was decided that the capability should be multimission; therefore, the DSN accepted full responsibility for the program.

In general, the program will:

- (1) Accept files of planned events versus time from various input sources, including other programs.
- (2) Compile all inputs into a time-ordered sequence of events (SOE).
- (3) For certain prespecified trigger events, compile predefined subsequences.

- (4) Automatically validate the SOE with respect to pre-defined criteria.
 - (5) Display the completed sequences (total or extracted) in formats convenient to the various users.
 - (6) Output extracted sequences in a high-speed data block format.
- (2) For a given event, certain time-sensitive supporting future events are in the sequence.
 - (3) Time constraints do not prohibit an event from occurring at, before, or after the time of another event.
 - (4) Mutually exclusive events do not occur at the same time.

There will be two types of inputs to the program: control inputs and sequence data inputs. The control inputs will be used to specify the mode of processing, file selection, and output formats. Sequence data inputs will include the event/time pair and reference time specifications. The reference time specification allows use of *launch minus*, *midcourse plus* and other such artificial time bases. Each time/event pair includes the time of occurrence of the event, in either GMT or one of the reference time systems, identification data and either a statement of the event or a trigger word which will cause a stored subsequence to be compiled. Inputs will be either manually entered via cards or keyboard, or transferred from another program. For *Mariner Mars 1971*, the COMGEN (command generation) program will supply spacecraft command information and the PREDICTS program will supply station rise and set times, and one two-way light time to the spacecraft. Actual scheduled station track times will be manually entered, although it is hoped to automate this interface in the future.

After a sequence is compiled, a validation process will be invoked. This process will check to assure that:

- (1) For a given event, the sequence has necessary prerequisite events. For example, a DSS must be able to view the spacecraft before commanding it.

Failure to validate will result in an alarm message to the operator.

Three primary outputs will be available. The high-speed data output will be used to transmit sequences to remote sites, such as supporting DSSs. A text listing will provide tabular prints up to 128 characters wide, with heading information such as item number, mission time, absolute time, station identification, report by-to, action, and Mission A events, depending upon the user's needs. Finally, a bar chart format will be available which will include the following header information: view periods for three stations, a local time scale, and a GMT scale. The period of time covered by the bar chart will be variable. The remainder of the page will be divided into fields; events will be placed across the fields according to time.

Operation of the program will be a cooperative effort between the DSN and supported flight projects. Within necessary constraints, anyone will be able to build his own sequences and access other's sequences. In this way the DSN will be able to compile a time ordered sequence of DSN events for all projects being simultaneously supported.

References

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